Nuclear Caloric Curves

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In the past year we have published two papers on the use of coalescence techniques to establish the nuclear caloric curve at freeze-out for medium mass (A~120) systems [1,2]. This caloric curve exhibits an apparent plateau at T = 7 MeV, in the 3.5- 7 MeV/ nucleon excitation energy range. This temperature is higher than those reported for similar excitation energies per nucleon by the Aladin Collaboration for ^{197}Au + ^{197}Au collisions and the EOS Collaboration for ^{197}Au + ^{12}C collisions. Indeed, caloric curves reported in the literature appear to vary significantly in both qualitative and quantitative aspects [3,4]. See Figure 1.

In order to determine the extent to which these variations might reflect real differences in the different systems studied or reveal some underlying systematic relationships, we have carried out a survey of such measurements, as reported recentlyat the National ACS Meeting in San Diego. For this survey we have restricted ourselves to reported measurements for which both temperatures and excitation energies have been corrected for contributions from sources such as pre-equilibrium emission or secondary decay.

That the results included in Figure 1 are for experiments which span a wide range of both mass and excitation energy is illustrated in Figure 2 which presents a plot of the derived values of the fragmenting mass as a function of the excitation energy associated with that mass.

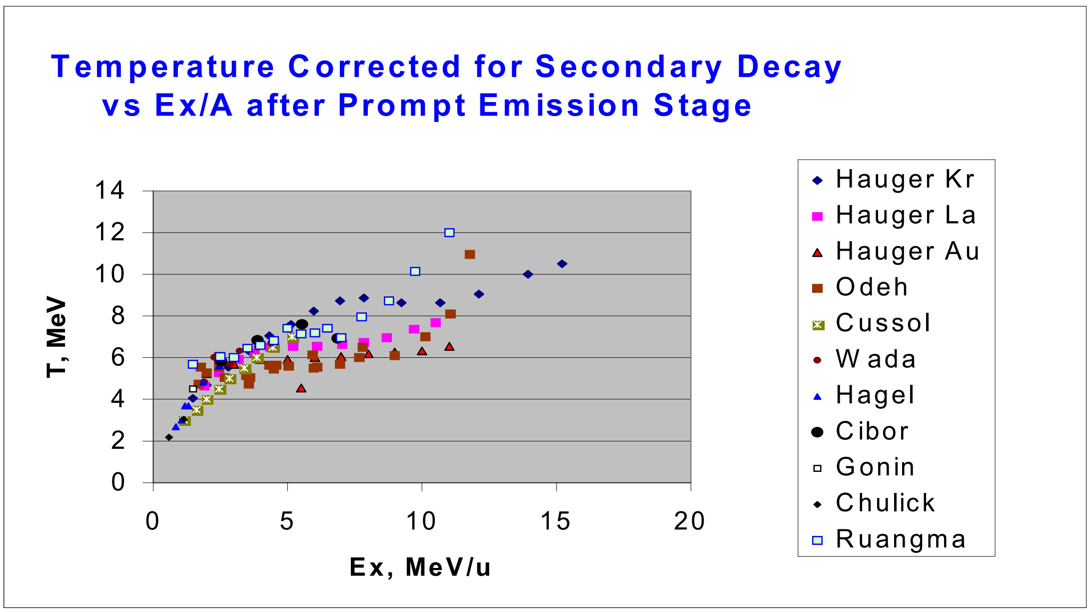

Figure 1. Temperature/Excitation Energy Measurements reported in the literature. Only systems for which both quantities have been corrected for extraneous contributions are included.

To explore a possible mass dependence of the caloric curve, we have, therefore, constructed "consensus" caloric curves for restricted mass ranges by combining appropriate data from the different experiments. Figure 3 shows results of such an analysis in the mass range A= 100 – 130.

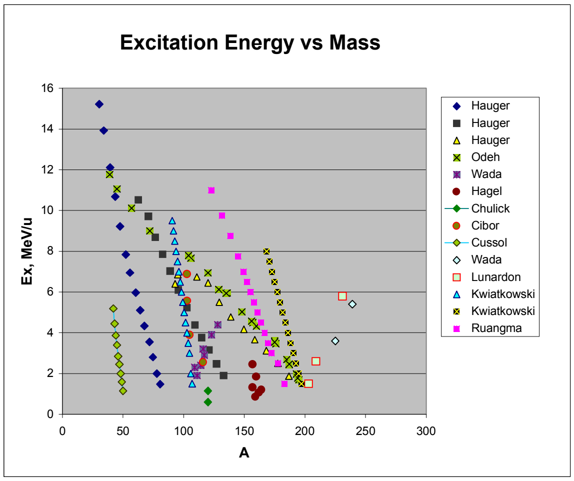

Figure 2: Excitation energy per nucleon vs mass of the fragmenting system.

These results, for this mass range, indicate a satisfying consistency of the available data. A similar consistency is obtained in other mass regions. Furthermore, at higher excitations, the available data show evidence of a mass dependence such as that long predicted in Coulomb instability calculations [3]

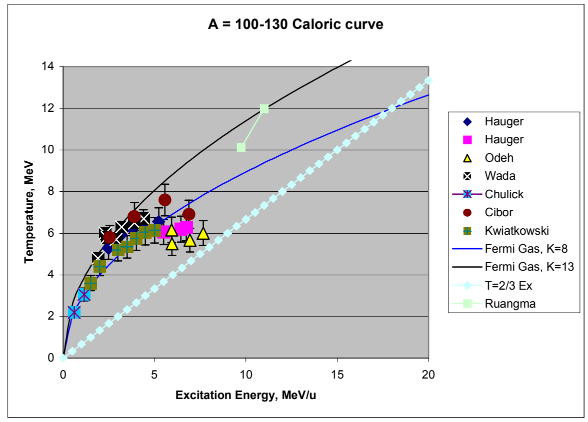

Figure 3: Community "consensus" caloric curve constructed from the available data for A= 100 – 130 nuclei.

These results will be discussed in detail in a publication of this work, which is presently in preparation.

References

[1] J. Cibor *et al.*, Phys. Lett. **B473**, 29 (2000)

[2] K. Hagel *et al.*, Phys. Rev. C **62**, 4607 (2000).

[2] L. L. Zhang *et al.*, Phys. Rev. C **59**, 3292 (1999) and references therein.